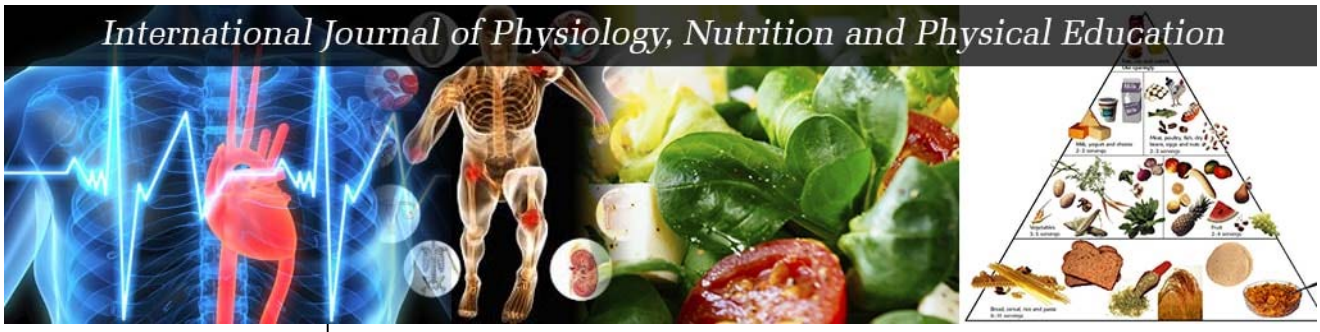


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# Development model of physical exercise agility and acceleration based on small sided games

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**Abstract**
The purpose of this research and development is to produce a model of physical exercise (nimrot) agility and acceleration on a football game for junior. In addition, research and development is conducted to obtain in-depth information on the development and application of models of physical exercise (nimrot) agility and acceleration on a football game for junior and determine the effectiveness, efficiency and appeal of athletes on the model created. Research and development using research methods development research & development (R & D) of the Borg and Gall. The subjects in this research and development is a junior soccer player many as 60 people. Instruments used in this research and development is a questionnaire, a questionnaire, as well as test instruments "Illinois test" used to collect the data level of agility, while the stages in research and development are, at this stage: (1) analysis of needs, (2) evaluation expert (initial product evaluation); (3) limited testing (small group testing); and (4) the main trial (field testing). Test the effectiveness of the model using the test "Illinois test" to determine the level of agility. Data were analyzed using "t-test" of data analysis obtained by the average value of pre-test 1612.03 and the average post-test 1403.13, the standard deviation of the pre-test 56.7 and post-test 54.3, the average pre-test and post-test 208.90 and standard 22:51 deviation value of 0.05 t 50.8 degree significant Since H0 is rejected. Test the effectiveness of the model using the test "30 meters acceleration test" to determine the level of acceleration. Data were analyzed using "t-test" of data analysis obtained by the average value of pre-test 450.10 and the average post-test 408.93, the standard deviation of the pre-test 10.38 and post-test 12.8, the average pre-test and post-test 49.167 and standard deviation 4.044. value of 0.05 t 66.599 degree significant Since H0 is rejected. Based on the information it can be said that the model of agility acceleration soccer game which is developed junior age effective and can increase agility and acceleration soccer player junior age.

**Keywords:** development, model training, agility, acceleration, soccer.

## 1. Introduction
In general, this paper exhibits the findings into the development of agility and acceleration in an athlete's abilities. This is done by using specific isolation training and with specialized sports training. Some of the exercises that can help improve an athletes acceleration and agility are; Slalom training: this form of exercise requires the athletes to weave between obstacles while running as fast as possible within a set activity area. The area can be set out in different patterns, such as winding slalom or zigzag slalom. This form of exercise is trying to implement and improve an athlete's directional agility, by doing the activity within a set area, with varying parameters; eg time allowed to perform the activity in different set ups of the obstacle course such as a straight slalom or a Z pattern. This provides different challenges for the athletes, The Shuttle Run, this is a form of exercise where the athlete performs the activity by running back and forth in a set area with varying distances. This is engineered to improve cardio vascular fitness and recovery. The coach can vary the activity by making the athlete sprint for the full distance and then a jogging recovery back, before they start their next set in the activity. Furthermore, acceleration development exercises, such as sprinting, can be enhanced by introducing specialized equipment. This can add resistance to the athlete's training exercise, by performing a running activity that requires them to pull a resistant weight behind them, Interval Training is a form of exercise that requires the athlete to perform within a set parameter of a programmed module. The program is designed to become more intensive as the training set progresses with recovery intervals in between intense running sessions.

The activity should enable the athletes to increase their performance output in the training session. The training area needs to be divided into three separate zones. The expectation for the first and third zones is for the athletes to run as fast as possible, while the second zone is a recovery zone. The players can reduce their speed and try to target an optimal speed-based performance of about 70-80 percent of their maximum speed, Hollow Sprints**.** Implementation of this exercise is about the players starting a running session with an optimal speed of 70-80 percent of their maximum performance speed. In the second part of the training the players should run at their maximum performance speed and the third part of the module should be at recovery speed of 70-80 percent, the same as at the start of the session.

The key to these models of exercise, that are mentioned above, all focus on the use of physical attributes of agility and acceleration. These are being targeted by the correct execution of the exercise within the training session. They all represent their own training demands and require special attention to each module of the training program. The models for the training exercises mentioned above is not sport specific to football only, but it means the base model can be used by other sports also. In principle, its own base model for the training promotes the concept of a player's agility and acceleration development during the exercise. These can be performed simultaneously while playing a series of a small exhibition football matches that incorporate the use of football skills. These can be practised to emulate the skills required based on a real football game.

The data showed that the acceleration and agility of football players enrolled in the Bina Taruna Football Academy (BTFA). For the junior age, most of the players were not able to reach the expected acceleration and agility levels set by the exercise modules. The training test was performed on 60 junior aged players of football BTFA by using "30 metrics acceleration test" and the "Illinois agility test". The results of tests conducted by researchers showed that only 4 people or 6.6% of the total number of players in the junior football team BTFA, were able to meet the training model standards. While 93.4% of football (Jakarta BTFA) players did not meet the acceleration and agility criteria needed to meet the exercise goal target. Results showed that the acceleration and the agility performance goals were only achieved by four players who achieved on average 4.50 seconds for acceleration and 15.87 seconds for agility using the test area set out by the researchers.

The development of the practice model with the ball was applied to the age group of junior level aged players (17-18 years). The researchers targeted this age for their test group, because at this junior age the playersalready havethe basic technical qualities, such as passing, dribbling and shooting and are already at the age where they are ready to transition into senior football.

The concept of research and development according to Borg and Gall in Zainal Arifin (2011: 27)[1] suggests "research and development are a powerful strategy for improving practice." Strength training is a new concept modifying existing practices. This can include computer software and printed material which is useful for anyone who uses it primarily in the field of education. Comprehensive understanding of similar models: Sukmadinata (2005: 64)[2] states that research and development is a process or steps to develop a new product, or refine existing products that results can be accounted for."

Some of the opinions contained in his book (2009: 86) Meyer, W J, stated "that the model is something real and converted to a more comprehensive form." Good and Travers in Sanjaya (2010: 82) [3] states that: "The model is a real-world abstraction or representation of complex events or systems, in narrative, mathematical, graphical, and other symbols."

James Tangkudung (2012: 58)[4] put forward seven principles of practice, namely the active and earnest principle, the principle of comprehensive development, the principle of specialization, the principle of individualization, the principle of exercise variation, the principle of model in the process of training, and the principle of overload. Harsono pointed out that "Exercise is a systematic process of practicing done repeatedly, with increasingly increasing the number of training loads and intensity of training". Exercise is essentially the following: 1) a systematic process to improve the performance of players in the form of: fitness, skills, and energy capacity. 2) pay attention to education aspect. 3) using a scientific approach (Joko Pekik, 2009: 1) [4].

Jay Dawes (2012: 15)[4] in his book developing agility and quickness means that agility is an ongoing movement that is composed of parts of the movement. Jay Dawes also added "Agility is a trainable motor skill that any athlete can improve through proper repetition". Greg Gatz (2009: 114)[5] states that "agility is an ability to react to situations quickly and start coordinating quickly and stopping to make the game under control."

Tudor Bompa (2009: 324) [6] states that "agility is the ability to stop, quickly change direction, accelerate in response to an external cue. Agility is influenced by two things: perception and decision-making ability and speed direction change." Lee Brown (2000: 79)[7] states" agility is the ability to reduce speed, increase speed and change direction quickly while maintaining good body position settings without having to reduce speed."

In the studying of physics, acceleration is represented by the symbol (a). "Acceleration is the rate of change in a given time unit. Acceleration is the time it takes to reach top speed and therefore can be seen as the rate of change for every bodymove" (Dan Gordon, 2009: 199)[8]. The understanding of acceleration comes from Newton's second law of Motion which states that: "when the body is exerting power, then the momentum change takes place in the prevailing direction: the change in momentum is proportional to the forces that causes it, but is inversely proportional to its mass." Therefore, we can define the acceleration by using the following formula: f / m where acceleration is the result of f force to mass m. In connection with this, there are a number of specific speed-based exercises that can be used to develop accelerated speeds.

Fox (1988: 314)[9] states that" acceleration is an increase in speed". As the name implies acceleration sprint involves a gradual increase in running speed from jogging to striding and finally to sprinting. A similar opinion is also expressed by Brown (2000: 19)[7] that "acceleration is an important speed development, and depending on the high frequency and length of the step. For most sports acceleration, which is the rate of change of velocity is the most importantcomponent of speed development and attainment." Following the start, all the athletes will accelerate by increasing both of stride length and stride frequency. Then Verheijen (1998: 143)[10] suggests that "good acceleration relies on a high stride rate." This is why

the central nervous system has to be taught how to control a higher stride rates. Players are not used to having to accelerate without being challenged in a straight line. During a long sprint the player has to continuously anticipate what is going to happen as the game situation changes.

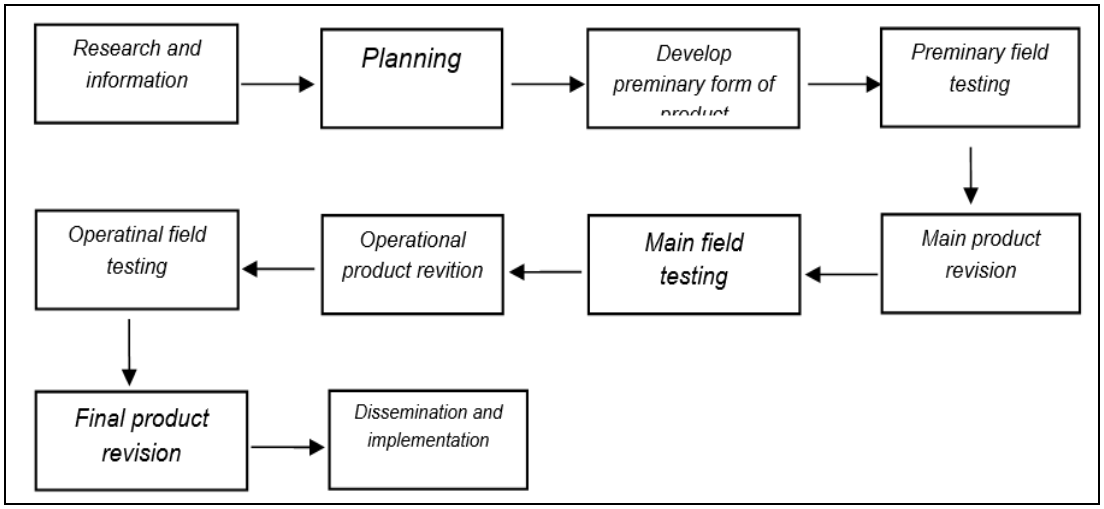
Verheijen further states that "sometimes a sprint has to be made over a longer distance (20150 meters), and the aim is to reach peak speed as quickly as possible. This usually this happen after 30 meters. The starting speed is the base from the body is accelerated (1998: 120) [10]."

### 1.1 Research Purposes

The purpose of this development study is to develop a model of physical exercise, exercise agility and acceleration in junior aged soccer games and know the effectiveness of the developed model.

## 2. Materials and Methods

Research and development in this exercise uses qualitative and quantitative approaches and uses Borg and Gall's Research & Development (R & D) development model consisting of ten steps in the figure below.




**Source:** Walter R. Borg and Meredith D. Gall, Educational Research: An Introduction, 4th Edition. (New York: Longman Inc., 1983)[11]

**Fig 1:** Instructional Design R and D

## 3. Results and Discussion

### 3.1 Result

1. The infrastructure used in the research should be free from environmental factors that can thwart the implementation of the research itself by ensuring the security of the infrastructure itself
2. The equipment used for the research was in the form of exercise cones, small wickets, and other training objects that ensured the course to be free of hindering factors that can thwart the implementation of the research program.
3. The various stages for executing the exercise module need to be adhered to as the warm up and the core exercises are done systematically to complete the exercise as per the research model.
4. Characteristics of the form of exercise presented in the study has led to the evaluation criteria of physical acceleration and agility exercise.The role of the trainer in the implementation of research exercise is an important part of the exercise module itself as the researcher can act as a motivator in the implementation of the exercise to reach the researchers targeted goals.
5. Based on the needs analysis and product revision of the 70 models that the participants used the statistics have been recorded as examples of results for physical acceleration and agility training. The training moduals the researchers used was engineered for the game of football for the junior aged division players. The Finalised results are as follows.

**Table 1:** Difficulty Physical Exercise Model

| S. No | Training Model | Explanation |
|---|---|---|
| 1 | 1,2,3,4,5,6,7,9,11,12,15,16,17,18,19,23,27,28,30,33,34,36,37,39,40,42,43,44,46,47,48,50,51,54,55,58,61,65,66,6 | Easy |
| 2 | 8,10,13,14,20,21,22,24,15,26,29,31,32,35,38,41,45,49,52,53,56,57,59,60,62,63,64,67,68,69,70 | Complex |

**Table 2:** Model of Physical Exercise Based on Basic Football Technique

| No | Training nimrot Model | Explanation |
|---|---|---|
| 1 | 1 to 7 | Principle of *dribbling* |
| 2 | 8 to 41 | Principle of *Passing* |
| 3 | 42 to 67 | Principle of *Shooting* |
| 4 | 68 to70 | Principle of *Combination Playing* |

### 3.2 Small Group Trial Results

The models designed for agility and acceleration exercises, for the training of junior football players, were adapted after evaluation and then phase I of the training program was revised. After the initial product design was revised the training model was tested on a small trial group with 15 research subjects.Based on the evaluation of small group trial conducted by the researchers the results can be concluded as follows:

1. Basically all the variations can be applied, but must be adjusted from easy to difficult levels to help improve the player's ability in the exercise.
2. There needs to be a demonstration of the exercise so that the players can easily comprehend the exercise elements

that they will be undertaking in the training session.
3. One element of the kicking module is that the ball must be stationary; the kick must be firm in order to accelerate the ball, to apply more leverage and accuracy to the ball.
4. Kick accuracy should be kept in mind.
5. Concentration and staying focused on the task of the programmed exercise.
6. Accurate shooting, timing and ball control is one of the first disciplines of the Nimrot training session and it is anticipated that the players will be enticed into participating in another Nimrot training session.

### 3.3 Large group trial results

After the initial testing of the product, developed for the agility and acceleration training model, for the junior age soccer, on a small scale, the results have been revised. The next step is to conduct tests on a larger group trial. Based on the results of a limited trial (small group trial), it has been evaluated by the researchers and compared to the experts findings. The researchers revised the initial product and analised the effectiveness of the 70 exercise models of agility and acceleration exercises for junior-aged soccer players that will be used in large group trials.

The next step was to revise the model in phase II of the expert program, then the researchers proceeded to test the product models on a larger groups.

The researchers used a group of 60 junior players as their research subjects. The group was randomly split in half. Thirty of the players participated in a research test group using varying training modules. The second group of 30 players made up a the test control group.

**Table 3:** Test of differences effectiveness agility junior soccer player with spss 22 treatment groups

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | VAR00001 | 1612,0333 | 30 | 56,73379 | 10,35813 |
| | VAR00002 | 1403,1333 | 30 | 54,30738 | 9,91513 |

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | VAR00001 & VAR00002 | 30 | ,919 | ,000 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | VAR00001 - VAR00002 | 208,90000 | 22,51030 | 4,10980 | 200,49451 | 217,30549 | 50,830 | 29 | ,000 |

Based on data analysis, the mean value of pre-test 1612.03 and average post-test 1403.13, standard deviation of pre-test 56.7 and post-test 54.3, mean pre-test and post-test 208.90 and standard deviation 22.51 t value 50.8 significant level 0.05 Because H0 rejected, Based on the description above it can be said that the model of agility and acceleration exercise in the junior aged soccer development can effectively improve the agility and acceleration of junior football players.

**Table 4:** Test of differences effectiveness of agility of junior soccer player age with spss 22 control group

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | VAR00001 | 1709,3333 | 30 | 47,44822 | 8,66282 |
| | VAR00002 | 1615,5333 | 30 | 50,66369 | 9,24988 |

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | VAR00001 & VAR00002 | 30 | ,884 | ,000 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | VAR00001 - VAR00002 | 93,80000 | 23,85791 | 4,35584 | 84,89131 | 102,70869 | 21,534 | 29 | ,000 |

Based on the data analysis, the average pre-test value of 1709.33 and the average post-test 1615.53, standard deviation pre-test 47.44 and post-test 50.66, average pre-test and post-test 98.80 and standard deviation 23.85 t value 21.53 significant level 0.05 Because H0 is rejected. From the analysis of the data the control groups performance also increased, but was very low compared to the research test group for the development of the Nimrot exercise model.

**Table 5:** Test differences effectiveness of junior football player acceleration with spss 22 treatment groups

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | pre | 458,10 | 30 | 10,387 | 1,896 |
| | post | 408,93 | 30 | 12,080 | 2,205 |

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | pre & post | 30 | ,946 | ,000 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | pre - post | 49,167 | 4,044 | ,738 | 47,657 | 50,677 | 66,599 | 29 | ,000 |

Based on data analysis, the average value of pre-test 450.10 and the average post-test 408.93, standard deviation pre-test 10.38 and post-test 12.08, mean pre-test and post-test 49.167 and standard deviation 4,044 t value 66599 significant level 0.05 Because H0 rejected, Based on the description can be said that the model of agility and acceleration exercise for the junior age soccer players for their development was effective and can improve the agility and acceleration of junior football players.

**Table 6:** Test of effectiveness differences accelerated junior age of soccer players with spss 22 control groups

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | pre | 459,93 | 30 | 13,625 | 2,488 |
| | post | 436,60 | 30 | 9,309 | 1,700 |

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | pre & post | 30 | ,971 | ,000 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | pre - post | 23,333 | 5,088 | ,929 | 21,434 | 25,233 | 25,120 | 29 | ,000 |

Based on data analysis, the average value of pre-test 459.93 and average post-test 436.60, standard deviation pre-test 13.625 and post-test 9.30, average pre-test and post-test 23.33 and standard deviation 5,088 t value 25,120 significant level of 0.05 Because H0 is rejected. From the analysis of the data in the control test group also increased, but very low compared with the research test group of the training development Nimrot model.

### 3.3 Discussion

**Product Improvements**

Based on the acquisition of figures in the table above it can be concluded that the model of agility and acceleration exercise in a junior-aged soccer players can and is feasible for use in soccer skills training as well as being effective to improve agility and acceleration junior aged players.

Seeing the shortcomings and advantages of the products results the researchers were able to convey the achievement obtained for this product and allow for its improvement, some of the researchers improvement inputs are as follows:

1. Because this is a flexible model it is necessary to adjust the program to suit the junior aged players so they are able to practice the movements and skills required.
2. Repetition of the same training exercises will further help the player to improve their agility and acceleration.
3. Paying attention to players safety during the exercise to maintain safety for the players and avoid injury during the exercise.
4. If more than one form of exercise are used in the same practice session, attention should be payed to the complexity of the exercise.

### 3.4 Product Discussion

The model of agility and acceleration exercise in junior soccer games developed and created by researchers is a product that aims to help coaches in the world of football, to improve agility and acceleration junior age players, and as a reference model of exercise. Models of agility and acceleration exercise for junior aged soccer players is made based on the level of junior aged players need to have activity and exercise.

This product after reviewing some weaknesses that need improvement, it can be delivered some advantages of this product include:

1. Increased personal agility and acceleration abilities of junior football players
2. To help encourage the players so they are more enthusiastic in their practice session and they also understand the long term benefits to be gained by participating in the training exercise.
3. Increasing the enthusiasm of the players by listening and participating in instructional lessons from their coach
4. Ensuring the Models for agility and acceleration training are effective and efficient
5. To assist the coaching staff by helping them implement training models used to improve the agility and acceleration of their players.
6. Models can be used as a reference material for training exercise to improve the agility and acceleration of players.
7. Contribution to the ongoing research into the science of professional football coaching.
8. The models for agility and acceleration exercise training for junior age soccer players can be set in a flexible format, that can be vary from easy to difficult, depending on what skill levels the coach wants to obtain in each session.

### 3.5 Product Limitations

This development and research model has been pursued to the fullest of the researchers ability within the limitation to access to expert information in this field and in accordance with the of the researchers resources, but in this study there are still some limitations that must be acknowledged. Some of the limitations are as follows:

1. Field trials for this study will be more informative if done using a wider scope of players
2. The products used are still under development and are far from completed.
3. The researchers access to facilities and infrastructure required are still limited.
4. The instructions and rules set out in the Models for agility and acceleration exercises for the junior-age soccer players are still under development and far from completed.

## 4. Conclusion

Based on the data obtained from the Nimrot field trials and the discussion between the researchers over the results, it can be concluded, that with further development of the models for agility and acceleration exercise in junior-age soccer players, it can be tested and implemented into the soccer training practice to improve player skills and performance. Results from the field trials allows for further research to be done into agility and acceleration training for junior-age soccer players, as this program is still under development. It was shown by the data obtained that the effectiveness of the training, that was completed, gave an encouraging result for junior age soccer players. The initial results can be seen as feasible for the future implementation of the Nimrot training models in soccer practice sessions by a coach.

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